CLAIMS

1. An oil extraction method comprising:

pumping a solvent in liquid phase from a solvent reservoir through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and the oil;

depositing the solvent/oil mixture in a distillation tank;

distilling off the solvent from the mixture in the form of a solvent vapor; and

thermally driving the solvent vapor from the tank back to the reservoir by applying a temperature differential, while leaving the oil in the distillation tank.

2. The method of claim 1 further comprising cyclically repeating the pumping, depositing, distilling and driving steps with the same solvent that is returned to the reservoir in the previous driving step.

3. The method of claim 1 wherein the pumping, depositing, distilling and driving steps are performed continuously and simultaneously, with the solvent flowing cyclically through the reservoir and the distillation tank.

4. The method of claim 1 wherein the reservoir and the distillation tank are parts of an oil extraction system that is closed to the atmosphere during the pumping, depositing, distilling and driving steps, and the method further comprises replacing the solvent in the reservoir with a second solvent while the system remains closed to the atmosphere.

5. The method of claim 4 wherein the second solvent is of different molecular structure than the first solvent.

6. The method of claim 1 wherein the solvent temperature is below -30 degrees F as it is being pumped and extracting the oil from the oil containing material.

7. The method of claim 1 wherein the solvent temperature is at a cell breaking temperature as it is being pumped and extracting the oil from the oil containing material.

8. The method of claim 1 wherein the driving step includes thermally driving the solvent through a filter to the reservoir, and the distilling and driving steps reclaim the solvent to virgin standards.

9. An oil extraction system comprising:

a reservoir for holding a solvent liquid;

an extraction tank for flowing the solvent liquid through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and oil;

a distillation tank for distilling off the solvent from the mixture in the form of a solvent vapor;

a pump configured to pump the solvent liquid from the reservoir to the extraction tank; and

a thermal drive apparatus configured to thermally drive the solvent vapor from the distillation tank back to the reservoir.

10. The system of claim 9 wherein the thermal drive apparatus includes a heating device for heating the mixture in the distillation tank and a cooling device for cooling the solvent in the reservoir, to produce a temperature differential between the reservoir and the distillation tank.

11. The system of claim 9 further including a chiller, connected between the distillation tank and the reservoir, that is located above the reservoir and that cools the solvent vapor from the distillation tank for the solvent vapor to condense and fall into the reservoir.

12. The system of claim 9 configured for the solvent to flow cyclically through the reservoir, the extraction tank and the distillation tank.

13. The system of claim 9 configured for the solvent to flow simultaneously through the reservoir, the extraction tank and the distillation tank.

14. An oil extraction apparatus comprising:

first and second oil extraction systems, each system including a reservoir for holding a solvent in liquid phase, an extraction tank for receiving and flowing the solvent liquid through an oil containing material for the solvent to extract oil from the material to yield a liquid mixture of the solvent and the oil, a distillation tank for receiving the solvent/oil mixture and distilling off the solvent from the oil in the form of a solvent vapor, and a return line for returning the solvent vapor to the reservoir while leaving the oil in the distillation tank; and

an oil collection tank connected to both distillation tanks for collecting the oil from both distillation tanks.

15. The oil extraction apparatus of claim 14 wherein each system further comprises a pump for pumping the solvent from the reservoir to the extraction tank and a thermal drive apparatus configured to thermally drive the solvent from the distillation tank to the reservoir.

16. The oil extraction apparatus of claim 14 wherein each system is configured to be closed to the atmosphere during the flowing, the extracting and the distilling, and further configured to enable replacing the solvent with a second solvent while the system remains closed to the atmosphere.

17. An oil extraction system comprising:

a reservoir for holding a solvent liquid;

an extraction tank for flowing the solvent liquid through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and oil;

a distillation tank for distilling off the solvent from the mixture in the form of a solvent vapor; and

a return line for returning the solvent vapor back to the reservoir;

the system being configured to be closed to the atmosphere during the flowing, the extracting and the distilling, and further configured to enable replacing the solvent in the system with a second solvent while the system remains closed to the atmosphere.

18. An oil extraction system comprising:

a reservoir for holding a solvent liquid;

an extraction tank for flowing the solvent liquid through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and oil;

a distillation tank for distilling off the solvent from the mixture in the form of a solvent vapor; and

a thermal driving apparatus configured to thermally drive the solvent vapor from the distillation tank to the reservoir, the apparatus comprising a heat pump having a cold side configured to withdraw heat from the system at the reservoir and having a hot side configured to add the heat back to the system at the distillation tank.

19. An oil extraction system comprising:

a reservoir for holding a solvent liquid;

an extraction tank for flowing the solvent liquid through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and oil;

a distillation tank for distilling off the solvent from the mixture in the form of a solvent vapor; and

a line, closed to the atmosphere, for conducting the liquid solvent from the reservoir to the extraction tank, and conducting the mixture from the extraction tank to the distillation tank, and conducting the solvent vapor from the distillation tank to the reservoir; and

a purge tank for purging, from the line, a contaminant that is more volatile than the solvent without interrupting the flowing, the distilling and the conducting, the purge tank having an inlet for receiving the solvent and the contaminant from the line, a cooling device for condensing the solvent but not the contaminant, a lower outlet for discharging the condensed solvent back into line, and an upper outlet for discharging the contaminant into the atmosphere.

20. An oil extraction method comprising:

flowing a liquid solvent from a solvent reservoir through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and the oil;

depositing the mixture in a distillation tank;

distilling off the solvent from the mixture in the tank in the form of a solvent vapor; and

thermally driving the solvent vapor from the tank back to the reservoir by applying a temperature differential, the temperature differential being achieved by withdrawing heat at the reservoir at a first rate and adding the heat to the distillation tank at a second rate, the rates differing from each other by less than about 2%;

the flowing, depositing, distilling and thermally driving steps being performed continuously and simultaneously with the solvent flowing cyclically through the reservoir and the distillation tank.

21. The method of claim 20 wherein the withdrawing and the adding of heat are respectively provided by hot and cold sides of a single heat pump.

22. An oil extraction method comprising:

flowing a liquid solvent from a solvent reservoir through an oil containing material for the solvent to extract oil from the material to yield a mixture of the solvent and the oil;

depositing the mixture in a distillation tank;

distilling off the solvent from the mixture in the tank in the form of a solvent vapor; and

returning the solvent vapor from the tank back to the reservoir in a state meeting virgin standards.